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Biomass and Bioenergy

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BIOENERGY**

International Energy Agency

IEA Bioenergy

U P D A T E 48

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News from the Secretariat

The 66th meeting of the Executive Committee was held in York, UK on 12-14 October with Josef Spitzer as Chairman and John Tustin as Secretary. The meeting was hosted by the Department of Energy and Climate Change (DECC). The Chairman expressed the appreciation of the ExCo to Kieran Power for the excellent meeting and study tour arrangements. Some of the outcomes of the meeting are detailed below.

New Contracting Parties

There is a new Contracting Party for South Africa – the South African National Energy Research Institute (SANERI). This change was effective from 26 July 2010.

Changes in the Executive Committee

A new Member is: Dr Thembakazi Mali, South Africa. New Alternate Members are: Ms Bodil Harder, Denmark; and Ms Alba Departe, France.

Election of Chairman and Vice Chairman

Birger Kerckow of Germany was elected Chairman and Paul Grabowski of the USA was elected Vice Chairman for 2011.

ExCo66 Workshop

A very successful workshop on 'Thermal pre-treatment of biomass for large-scale applications' was well attended by ExCo Members, Task Leaders, and Observers from the UK. The workshop presentations are listed below:

- 'Overview of thermal pre-treatment processes

for large-scale biomass applications' – Dr Ir Jaap Kiel, Programme Manager Biomass and Coal, ECN, the Netherlands

- 'Biomass pyrolysis' – Professor Tony Bridgwater, Aston University, UK
- 'Overview of full-scale gasification processes' – Dr Reinhard Rauch, TU Wien, Austria
- 'The GoBiGas project: efficient transfer of biomass to biofuels' – Dr Ingemar Gunnarsson, Göteborg Energy, Sweden
- 'Bioenergy carriers: integrated pyrolysis and torrefaction concepts' – Professor Kai Sipilä, VTT, Finland
- 'The pyrolysis of biomass to give us biochar and using it as a soil improver' – Dr Michael Weaver, Pyreg Ltd, Germany
- 'LCA of thermal processes: examples for gasification and pyrolysis to transportation biofuels, electricity and heat' – Dr Gerfried Jungmeier, Joanneum Research, Austria

For more detail please visit www.ieabioenergy.com/DocSet.aspx?id=6735&ret=dss

Progress with Current Initiatives

- *New Strategic Plan.* The Strategic Plan 2010-2016 has been printed and distributed. Further work is now being initiated to link the 'objectives' of the Strategic Plan with 'actions and performance indicators'. The goal is to provide guidelines for monitoring progress with the plan and thereby strengthen the transparency of the work undertaken by IEA Bioenergy.

- *The Pellet Handbook: the production and thermal utilisation of biomass pellets;* This book is now

printed and an excellent publication has resulted. This strategic project was co-funded by the ExCo (through Task 32) and the Austrian organisations Landesenergieverein Steiermark and BIOS Bioenergysysteme GmbH. The handbook was edited by Ingwald Obernberger and Gerold Thek. Each Member Country received a complimentary copy via its ExCo Member. Further copies are available from Earthscan (www.earthscan.co.uk/?tabid=102497).

- *Bioenergy, Land Use Change and Climate Change Mitigation*. A report by Goran Berndes for policy makers and policy advisors has been circulated for ExCo approval by written procedure and is expected to go to print in December 2010.
- *LCA strategic paper*. Another draft was produced for review by the ExCo subgroup on 15 May 2010. The review identified the need for further improvements in the content. A Consultant Editor has been engaged to work with the existing team. This is expected to accelerate progress with this very topical deliverable.
- *Collaboration with RETD*. The joint project on 'Better Use of Biomass for Energy' produced a position paper for a side event at COP15. Since then, a more detailed background report has been produced and circulated. The Implementing Agreements now have a joint view of the role bioenergy can play. This completes a successful joint initiative.
- *AMF – Task 41, Project 3 'Fuel and Technology Alternatives for Buses'*. This project, initiated by VTT in Finland, is a joint Annex with Advanced Motor Fuels, Bioenergy, and Hybrid and Electric Vehicles. It aims to assess the overall efficiency, emissions, and costs (direct and indirect) for several fuel and drivetrain technology options for buses. Most of the testing of various fuel alternatives has already been carried out except for hybrid buses, where approximately one third of the testing has been completed. The project

involves a combination of desk studies and measurements on various types of buses. It is divided into two main parts, fuel pathway analysis (well-to-tank) and vehicle (tank-to-wheel) performance. The final report from the project is on target for completion in October 2011.

OECD Case Study

IEA Bioenergy was selected as the case study for an OECD project on 'Multilateral Governance of Science, Technology, and Innovation for Global Challenges'. The project was undertaken by the Committee on Science and Technology Policy. The Secretary prepared a comprehensive response to the project plus nine supporting documents. The report from the project was completed in November and is available on the IEA Bioenergy website.

ExCo67 Workshop

The theme for the next workshop will be 'Future Biomass-based Transport Fuels'. The objective will be to brief the ExCo and Task Leaders on current developments and highlight key activities which are shaping the future for bio-based fuels. The workshop committee is Wellinger (Convenor), Sipilä, Aarniala, Saddler, Kerckow, Maniatis, Dornelles, Grabowski, and Kwant. The availability of some members is still to be confirmed.

ExCo66 Study Tour

In conjunction with ExCo66, a total of 25 attendees participated in the study tour to the Drax Power Station in North Yorkshire. Drax is the biggest coal-fired station in the UK. The plant has an installed power capacity of 4,000 MW and provides 7% of the UK's electricity. The plant's operating company, Drax Power Limited, is planning to reduce its CO₂ emissions by 17.5% by 2011, compared to 2006 levels. The largest reductions in emissions will come from biomass co-firing. The co-firing facility is the largest of its type in the world. It has the capability to provide

500 MW of renewable energy and will reduce CO₂ emissions by two and a half million tonnes a year.

To make full use of its co-firing facility, Drax requires about 500 cubic metres of biomass to be unloaded, processed, stored, milled, transported, and fired every hour. Drax had previously been utilising its existing coal delivery system to deliver the biomass, and in the absence of a separate milling system, it was co-milling the biomass together with coal. This method had several drawbacks. Using an existing milling system limits the quantity and types of biomass fuels that can be fired. It can be difficult to reduce the size of biomass in mills designed to pulverise coal, and mixing fuels in the milling process causes more wear and tear. By installing a dedicated biomass delivery and milling system, Drax overcame these issues. In early 2008 Alstom Power were contracted to build the main processing works of a 1.5 million tonnes per year biomass co-firing facility. These processing works receive, handle, store, and process various biomass materials ready for direct injection into the power station's coal-fired boilers.

Drax has a special biomass team who source sustainable biomass worldwide. The biomass materials used include wood-based products, forestry residues and residual agricultural products, such as sunflower seed husks and peanut husks. Drax's focus on UK biomass includes energy crops (such as *Miscanthus*, short rotation coppice and short rotation forestry), traditional agricultural by-products such as straw, as well as woody biomass from the forestry sector. Until now their programme for energy crops has been facilitated by working with leading producer groups across forestry, farming and agricultural industries and this is something they intend to continue, although they believe to achieve the volumes needed more must be done. They have entered into long-term supply arrangements across the UK and internationally, thus ensuring diverse – and therefore secure –

sources of supply. They have also decided to work directly with individual farmers and land owners and offer direct off-take contracts for both energy crops and straw under their Green Shoots programme. Drax has developed and implemented a UK leading, comprehensive Sustainability Policy into its biomass procurement activities in order to ensure that suppliers adhere to best practice when growing biomass for use in power generation.

The study tour group was very impressed by the scale of operation and developments at the Drax Power Station. Chairman, Josef Spitzer, expressed the sincere appreciation of the group to the Drax staff who hosted a most informative and interesting visit.

Bioenergy in the United Kingdom

The UK Government has major ambitions for Britain to be a global leader in the move towards a low carbon economy. We want our future energy supplies to be clean, secure, safe, and cost-effective, as well as providing opportunities for investment and economic development. Sustainable bioenergy is likely to have a key role in the increasing decarbonisation of the UK's electricity grid and also in the spread of a decentralised, reliable low carbon heat supply.

Within the next ten years more than 18 GW of UK generating capacity is due to close. A number of nuclear power stations reach the end of their scheduled lifetimes while coal and oil generation is becoming subject to increasingly stringent environmental standards. UK indigenous energy, in the form of oil and gas from the North Sea, has passed its peak and we are seeing an increase in global demand for energy and intense competition for resources.

Against this background, and as a contribution to tackling the effects of climate change, the UK is committed to harnessing more energy from renewable sources. We have a challenging

and legally binding target for 15% of all energy consumed to come from renewable sources by 2020 (as part of the EU target for 20% by 2020). This is the biggest percentage increase in the EU. Our modelling suggests that, within a little over a decade, 7% of the UK's energy – across the electricity, heat, and transport sectors – could be sourced from bioenergy. This would deliver almost half of the UK's 15% target. Currently, biomass provides around 3% of UK electricity and 0.6% of heat. Yet by 2020, we estimate that around 10% of the UK's electricity could come from biomass and over 6% of our heat.

To support investment, the UK currently offers two support mechanisms designed to collectively support renewable electricity generation of all sizes, including from biomass; the Renewables Obligation (RO) for medium and large-scale generation, and a Feed-in Tariff (FIT) for power generation below 5 MW. These typically provide support levels fixed on accreditation for a 20 year period, and the RO alone will provide £1.4bn in financial support for renewables generation in 2010. In October 2010 the UK Government committed to a new incentive from mid 2011 for renewable heat generated by individuals, communities and businesses worth £850m.

There has been a good market response to the RO and FIT so far. To date, around ninety bio-electricity projects have been approved, nearly a quarter of which are under construction and will add 550 MW of installed capacity. Other projects awaiting construction would add an additional 1.8 GW. A further twenty bio-electricity projects are in the planning system which, if completed, could add a further 1.5 GW of installed capacity. Some seventy AD plants are in the pipeline, mainly intending to generate electricity. A rapid expansion in heat deployment is expected when details of the new renewable heat incentive are announced in early 2011.

One of the most important issues going forward is ensuring that the solid, liquid, and gaseous

biomass used in the UK is sustainable. From April 2011 we are introducing sustainability criteria for solid and gaseous biomass, as well as bioliquids, used for electricity generation. These will set out a minimum GHG saving of 60% relative to fossil fuel and restrictions on the use of materials from land important on carbon or biodiversity grounds such as primary forest, wetlands, and peatlands. These criteria will apply to domestic and imported biomass feedstocks. There will be an initial requirement for generators to report against the criteria, but from April 2013, receipt of incentives under the RO will be formally linked to meeting the criteria for generators of 1 MW or above. Biomass and biogas made from waste or landfill/sewage gas will be excluded from these requirements.

This article was written by Kieran Power, ExCo Member for the UK. For more information contact Isabella Connell at isabella.connell@decc.gsi.gov.uk.

Biorefineries: Co-production of Fuels, Chemicals, Power and Materials from Biomass

Task 42 started in 2007 with eight participants: Austria, Canada, Denmark, France, Germany, Ireland, the European Commission, and the Netherlands (Operating Agent). In the second triennium, participation increased to 13, with Australia, Italy, Turkey, UK, and the USA joining the Task. In terms of 'participation by Member Countries' the Task is now one of the larger Tasks within IEA Bioenergy.

Currently, biomass is mainly used for the production of human food, animal feed, materials, heat and/or power. However, in a transition to a biobased economy, biomass will be applied in more market sectors to meet their related policy goals. The overall demand for biomass will grow rapidly. Because available biomass resources are limited, these resources have to be processed as efficiently as possible. Biorefining – i.e. the sustainable synergetic processing of biomass

into both human food, animal feed, chemicals, materials, fuels, power and/or heat – is the best way to link future market demands to available biomass resources. By biorefining, optimal sustainable biomass value chains will be developed and deployed as a foundation for a biobased economy.

Classification System

The Task has developed a biorefinery classification system. Use of this system will give clear information to stakeholders on the type(s) of biomass used, the biomass-derived intermediates (platforms), and the final products and secondary energy carriers produced. The number of intermediates gives an indication of the complexity of the biorefinery facility, whereas the type of intermediates gives information for potential integration scenarios with other processes.

Depending on the type of biomass concerned, and the products required, different kinds of biorefinery conversion chains can be distinguished. Some classification examples are:

- A syngas platform biorefinery for the production of Fischer-Tropsch diesel, power and heat from straw.
- A C5/C6/lignin platform biorefinery for the production of bioethanol and mixed phenols from wood.
- A fibres/proteins biorefinery for the production of isolation materials, animal feed and chemicals from grass.
- A fibres/fatty acids biorefinery for the production of animal feed, chemicals and biodiesel from rapeseed.

Biorefinery Market Deployment

There is a need to speed up biorefinery market deployment. Some key points are:

- At present both bioenergy and biofuels for transport are supported by feed-in tariffs and regulation respectively; whereas the production of biobased products (food, feed, chemicals, and materials) is unsupported. Creation of a ‘level

playing field’ for sustainable biomass use for both bioenergy and biobased products is required to make biomass economically profitable, and environmentally and socially accepted in the global economy. New international policy goals based on the quality of biomass use are required.

- Biorefinery technologies are often still at an RTD stage. A risk insurance for scaling-up of these technologies to pilot and demonstration scale – requiring huge investments by industrial stakeholders – is necessary as compensation before final market deployment can take place.
- Industrial stakeholders from the agro, food, feed, chemical, fuel and energy sectors – normally operating in different market segments – need to be brought together, to develop and implement the most promising fully sustainable biomass-based value chains.
- The food-feed vs. fuel, and the biomass sustainability debate, has to be settled, to create the necessary societal support for the transition to a biobased economy.

Task Activities

The work programme for the 2010-2012 triennium includes:

- Finalisation of the Biorefinery Classification System to include more raw materials, conversion processes, biobased products, and secondary energy carriers. Coordinated by Austria.
- An inventory of the most promising biobased products (types, volumes, market prices) to be co-produced with bioenergy. Coordinated by the UK.
- Full value chain assessments of specific biorefineries – 10 biofuel-driven biorefineries (residues to biobased products) and 10 product-driven biorefineries (residues to bioenergy). Coordinated by Austria.

- Undertaking a review of approaches to biorefinery sustainability assessments, and preparing a 'guidance document' on this topic. Coordinated by Canada.
- Preparation of a strategic paper 'Biorefining for Adding Value to the Sustainable Use of Biomass'.
- Knowledge dissemination and outreach. For example, organising stakeholder meetings in the participating countries (twice a year), organising excursions to operating biorefinery plants, distributing Task newsletters and maintaining the Task website (including a database of commercial biorefinery plants, demonstration plants, pilot facilities, and major RTD projects).
- Preparation of Country Reports on the current situation and developments within the biorefinery field in the participating countries.
- Organisation of a biorefinery training course and summer school.

For more information on Task 42, please visit: www.iea-bioenergy.task42-biorefineries.com

News from the Tasks

Task 34: Pyrolysis of Biomass

All National Team Leaders were present at the recent meeting of the Task on 16-17 October in Stratford-upon-Avon, UK. The meeting included a tour of the biomass pyrolysis laboratories at Aston University hosted by Professor Tony Bridgwater. The agenda focussed on country reports, developments in norms and standards, and planning for a seminar on 'upgrading bio-oil by catalytic hydroprocessing which is tentatively scheduled for September 2011 in Chicago, USA immediately following the GTI Thermochemical Conversion Science Conference. An important outcome of the meeting

was the finalisation of a round robin analysis of bio-oil samples for viscosity and thermal aging. The potential participants include 23 laboratories in the five participating countries. The results are expected for the next Task meeting on 6-7 April 2011 in Hamburg, Germany. This meeting will include a tour of the vTI pyrolysis laboratories and the nearby PyTec demonstration plant.

Task 39: Commercialising Liquid Biofuels from Biomass

Task 39 has been very productive. The Austrian participants completed a report 'Status of 2nd Generation Biofuel Demonstration Facilities' in June 2010 which is now available on the Task website. This report is accompanied by an interactive 'biofuel company' database that provides details on conversion technologies, feedstock, and other plant logistics. While most of the facilities described in the database are located in Europe, North America and other OECD countries the Task is working closely with colleagues in countries such as China, India, South East Asia and South America to expand the database into a global resource. Companies worldwide are being encouraged to share their information so that the database can include all the so called 2nd generation biofuel facilities. The Task also completed two other reports: 'An Overview of the Sustainability Criteria for Biofuels' and 'Current Status and Potential for Algal Biofuels Production'. These reports will be made available to public stakeholders after they have been reviewed by the Task participants. Task 39 continues to build an international community around the liquid biofuels area through the website and the newsletter (Issue 25 now available). It undertook a rebranding effort to update the look and feel of the Task website and to facilitate easier communication and information dissemination. The new website (www.task39.org) has been launched.

In December 2010, the Task met in Sydney, Australia in conjunction with the annual

Bioenergy Australia conference. The theme of the conference was 'Biomass for a Clean Energy Future' and included an emphasis on liquid biofuels and in particular algal biofuels.

Task 40: Sustainable International Bioenergy Trade

The Task held a joint workshop with EUBIONET III on 'International trade of bioenergy commodities: experiences with certification and setting up sustainable supply chains' on 21 October in Rome.

Europe's demand for bioenergy is growing and increasingly the demand for biomass commodities will be served through international trade. Until recently, sustainability criteria for bioenergy commodities have been developed by numerous organisations, but binding legislation on sustainable production of biomass for energy was largely missing, and various market parties came up with voluntary standards. With the publication of mandatory sustainability criteria for liquid transport fuels in the Renewable Energies Directive by the European Commission, this situation has changed. Also in the USA, the Renewable Fuel Standard (included in the Energy Independence and Security Act) recently mandated minimum GHG reductions from renewable fuels, discouraged the use of food and feed crops as feedstock, permitted the use of cultivated land and discouraged land use change. On the other hand, for solid biomass and biogas for heat and electricity, a recent report by the EC concluded that binding criteria for solid biomass are not necessary. Given these developments, it is likely that sustainability criteria will have a potentially much larger impact on the trade of liquid biofuels compared with the trade in solid biomass.

Some observations and conclusions from the workshop were:

- Participants gained a good overview of the activities of governments, market parties and NGOs regarding the implementation of

sustainability certification schemes and the general efforts being made to assure sustainable biomass production, trade and use. Case studies from Belgium, Brazil, the UK, and Mozambique showed a lot of activity on certification of liquid biofuels, and to some extent solid biofuels. Valuable experiences have been gained with systems such as the RTFO and the Laborelec label, proving that sustainability certification is feasible in practice. Yet, it remains a challenge for producers, traders and end-users to source sufficient sustainably produced liquid biofuels.

- An important issue is the large variety of certification systems, which can confuse market actors and cause additional market barriers. However, within the EU, there is a trend towards harmonisation, thanks to the mandatory EU sustainability criteria for liquid biofuels. It remains uncertain exactly how certification for the Renewable Energies Directive will take place, and to what extent imported biofuels will be able to meet the criteria. On the question of voluntary or mandatory sustainability criteria for solid biomass, the decision by the EC is pending until the end of 2011 but many large European end-users favour mandatory criteria.
- An ongoing discussion concerns direct and indirect land use change (iLUC). All of the participants recognised the importance of iLUC, but opinions varied in terms of, if and how it should be included in biofuel certification schemes. Several methodological approaches exist to quantify the effect of iLUC caused by biofuel production, but the key question remains whether such an approach should focus on overall sustainable land use by agriculture and forestry, rather than just on bioenergy crops.

The workshop presentations can be downloaded from the Task 40 website www.bioenergytrade.org.